Agricultural research

U.S.DEPARTMENT OF AGRICULTURE SEPTEMBER 1974

agricultural research

September 1974/Vol. 23, No. 3

Buckwheat Boom

For some 200 years buckwheat has helped epitomize the hearty fare of American country life. In simpler times our forebears often celebrated the completion of a cold morning's chores with a steaming stack of buckwheat griddle cakes accompanied by generous servings of ham, eggs, bacon, or sausage. By 1900, however, the production of buckwheat began a long and drastic decline, victim of changes in industrial man's breakfast habits and in the economic realities of agriculture.

Today buckwheat is enjoying a resurgence of popularity, one requiring millers to contract with growers to meet the demand. Ironically, part of this renewed interest is attributed to people seeking the more relaxed lifestyles of the "old days," including the revival of some of yesterday's foods. The demand has also been heightened by the success of a commercially prepared breakfast cereal and by exports to Japan for making buckwheat noodles. Perhaps the boom rests mainly on the nutritional excellence of buckwheat. ARS analyses indicate the plant has an amino acid composition nutritionally superior to all cereals, including oats. Buckwheat protein is particularly rich (6 percent) in the limiting amino acid lysine. There is a protein potential to tap in buckwheat, but first there are problems to solve.

One problem is that buckwheat has a trait that botanists call indeterminate growth: the plant puts forth vegetative and flowering growth until frost, thereby reducing seed set and yield. Further, buckwheat does not respond well to fertilization. Moreover, the plant's weak and hollow stems lead to lodging and yield losses. And most critical, there has been little effort to improve the crop through plant breeding since buckwheat is naturally cross-pollinated and cannot be inbred because of self-incompatibility. Accordingly, buckwheat yields, unlike those of other crops, have remained stable and thus discouraged production.

ARS is making progress toward surmounting these obstacles. A significant advance came with the development of Pennquad, the first tetraploid buckwheat in North America. Pennquad has large seeds of uniform size and thick stems that resist lodging, thereby reducing harvesting losses. A recently discovered flower type has obviated the self-incompatibility problem by facilitating the development of inbred lines, like Pennline 10, for release to breeders; hopefully this effort will lead to higher yielding and agronomically superior cultivars. A vital working tool is the buckwheat germ plasm that ARS collected at home and abroad and which is shared with other researchers. Painstaking research will help buckwheat become a more valuable food—an encouraging prospect as mankind struggles to bolster the supply of protein foodstuffs.

CROPS
14 Coping with the sugar crunch
DISEASES
8 Guarding against a VEE attack
14 The threat of Jaagsiekte
PLANT SCIENCES
6 New chemical saves fish facility
SOIL AND WATER
5 Trenching improves clay soils
7 Making prairies blossom
UTILIZATION
3 Better polyvinylchlorides with starch
11 Summer protection for woolens
12 The secrets of Lebanon bologna
13 Pie thickener from apple wastes
AGRISEARCH NOTES
15 Higher yields with tall sorghums
15 APHIS tightens importation watch
16 Pheromone traps Comstock mealybug
16 Mirex and reproduction

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COVER: Veterinarian Thomas E. Walton (left) and biological technician Lee Thompson steady a horse on which entomologist Robert H. Jones allows mosquitoes in a feeding chamber to feed. The mosquitoes are maintained on horse's blood until they are infected with Venezuelan equine encephalomyelitis (VEE) virus for use in tests at the arthropod-borne Animal Disease Research Laboratory at Denver, Colo. (0674X808–38). Article begins on page 8.

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service (ARS), U.S. Department of Agriculture, Washington, D.C. 20250. Printing approved by the Office of Management and Budget through June 15, 1977. Yearly subscription rate is $3.60 in the United States and countries of the Postal Union, $4.50 elsewhere. Single copies are 35 cents. Send subscription orders to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Use of commercial names and brands is for identification only and does not imply endorsement or approval by USDA or ARS. Information in this magazine is public property and may be reprinted without permission. Credit will be appreciated but is not required. Prints of photos are available to mass media; please order by photo number.

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Better polyvinylchlorides with starch

CORN STARCH can be used to make new plastics, reducing pollution-littering problems, conserving scarce petroleum-derived raw materials, and cutting industry costs.

Degradable plastics have been made at the ARS Northern Regional Research Laboratory by adding cornstarch to standard formulas for polyvinyl chloride (PVC) and polyvinyl alcohol (PVA), widely used synthetics. Some products from each formula are more than half starch, new plastics by definition.

Most plastics do not decompose easily. They accumulate in disposal dumps and litter other areas. Some release toxic compounds when burned.

The new ARS plastics, however, are more degradable than plastics made entirely of petroleum-based resins. The starch—classified as a biodegradable agent—in the new formulas can be attacked by biological agents, thus aiding in the breakdown of the total product.

Although the plastic has been produced in the laboratory, no products have been made from them as of yet. Scientists envision that starch-PVC could be formed into trays, eating utensils, packaging materials, and other disposable items. The starch-PVA could be used in thin films for use in mulching vegetable crops.

Three techniques for making starch-PVC have been studied by chemists Richard P. Westhoff, Felix H. Otey, Charles L. Mehletretter, and Charles R. Russell of the Peoria, Ill., laboratory. In one test, they dry mixed cornstarch and powdered PVC. In another, the chemists concentrated mixtures of starch paste and PVC latex by drying. In the third test, the scientists precipitated mixures of starch xanthate and PVC latex to a curd with alum.

Chemist Felix H. Otey describes how one-time-use articles might be made from the starch-polyvinylchloride plastics. He holds samples of laboratory manufactured degradable plastic (right) and a bowl similar to many made today from nondegradable plastic. In the foreground are other nondegradable plastic products that presently cause disposal problems (0474A435–29A).

The techniques demonstrated the general feasibility of using starch to stretch supplies of polymers and resins, the starting materials for plastics, which are derived from petroleum. The studies are part of continuing Northern Laboratory research on using starch in plastics to cut costs, now underscored by the petroleum shortage and environmental concerns.

The precipitation technique is based on the work of another research team at NRRL which precipitated starch xanthate with rubber latex to make powdered rubber. Rubber is sometimes considered a plastic.

Using powdered rubber instead of slabs to form products can conserve energy. Starch xanthate acting as a reinforcing agent, furthermore, could replace some of the carbon black agents that are now made from petroleum.

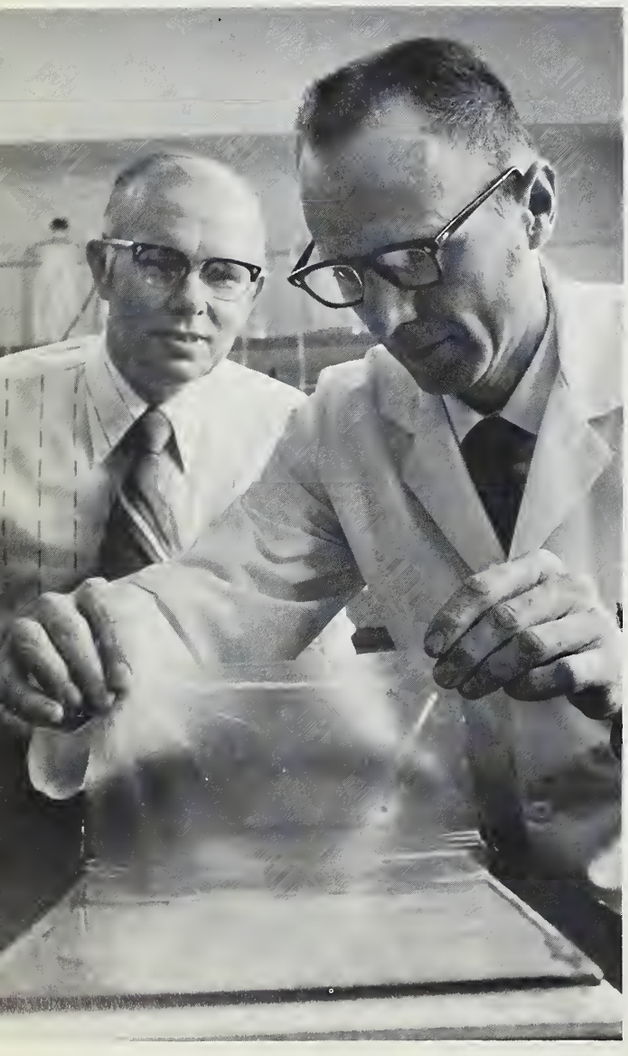
Starch derivatives were added to formulas for urethane plastics in Northern Laboratory studies more than 10 years ago. Mr. Otey, Dr. Mehletretter, and other chemists first made insulating foam, later floor tile and other products containing up to 60 percent starch.

The PVC studies show that, in general, starch reduces the plastic strength and increases water absorption and susceptibility to attack by soil microorganisms. But there are exceptions. When 30 percent starch was added by precipitation or concentration, for example, starch-PVC was stronger than the PVC control.

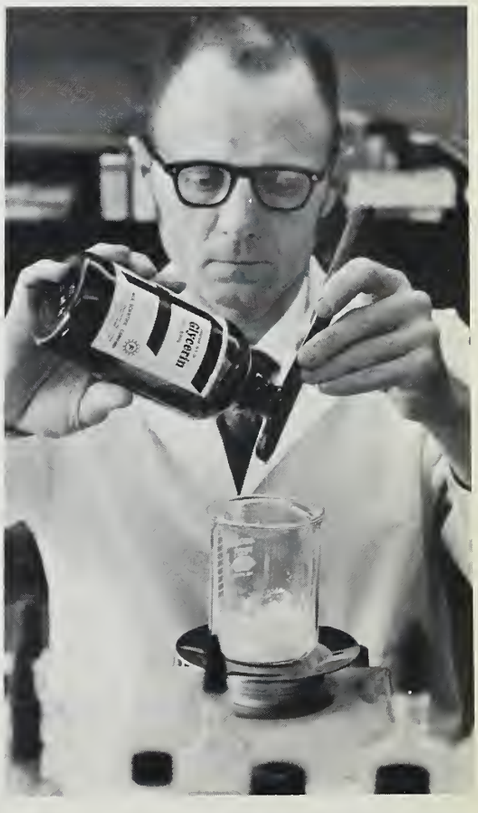
The starch-PVA film is an example of the usefulness of the degradable nature of the new plastics. In laboratory tests, the researchers have found that the lifespan of the film can be controlled by applying varying thicknesses of vinyl-resin coatings to the starch-PVA film.

The studies suggest that when the film is used as a crop mulch, the different coating thicknesses could be correlated to the different growing times of various crops. At harvest time, the protective vinyl-resin would then deteriorate, exposing the starch-PVA film to the erosive factors of sun, wind, and rain. The new film would save farmers the time and expense they now incur in removing the nondegradable plastic mulches from their fields.

Plastic susceptibility to micro-organisms does not increase uniformly with starch level. "But in the time available after disposal," Mr. Otey said, "almost any degree of susceptibility should be enough to start decay. The plastic will lose strength, become brittle and break down because of erosive forces." □



Left: After oven drying to evaporate water from the slurry, chemist Richard P. Westhoff (right) and Mr. Otey strip cured film from a glass plate. The film will be coated with water repellent vinyl-resin to prolong its life and then analyzed for strength, flexibility and weatherability (0474A437–10A). Center: A pilot-plant roll of coated starch-PVA film, which was produced by a commercial manufacturer, is examined by Mr. Otey. This film is now ready for field testing as a degradable mulch (0474A435–2A). Right: Mr. Westhoff formulates the starch-plastic slurry. After mixing, the slurry will be heated to 95° C. and cast onto glass plates to produce a film 30 mils in thickness (0474A438–33).



Trenching improves clay soil

Various techniques and methods of soil profile modification have been tried to increase plant growth and crop yield—now come narrow backfilled trenches that show promise for clay soils.

In a 3-year study conducted in the Lower Rio Grande Valley of Texas, ARS soil scientists Marvin D. Heilman and Candelario L. Gonzalez found that narrow trenches backfilled with soil or with such soil conditioners as vermiculite, then covered with soil, improved soil condition, increased water infiltration, and increased crop yield.

In the study conducted at Weslaco the researchers dug a series of 10-centimeter (cm) wide trenches in a representative Harlingen clay soil. One-third of the trenches were 61 cm deep, filled with 45 cm of vermiculite, and covered with soil. Another third were 61 cm deep and completely filled with soil. The final third were 102 cm deep and completely filled with soil. A control plot received conventional tillage.

Beds were formed directly over the trenches and planted to cotton in all 3 years and were irrigated at planting to insure seedling emergence.

Growth of the cotton plants was significantly influenced by the treatments during each of the three seasons. But, because of a severe infestation of cotton bollworms and tobacco budworms during the first year, yields that year were not significantly different from those of the control plot.

In the second and third years, however, yields were substantially higher from plants grown above the backfilled trenches with the best yields obtained from cotton grown above the trenches backfilled with vermiculite and topped with soil. In the second year, yields ranged from 21 percent higher than the control for the 61-cm trench backfilled with soil, to 43 percent for the 61-cm trench backfilled with vermiculite and soil. Yields from the 102-cm trench back-filled with soil were 25 percent higher than the control.

During the third year the results were not as dramatic, but differences were nonetheless significant. Yields were higher than the control by 13 percent for the 102-cm trench, 15 percent for the 61-cm trench backfilled with soil, and 27 percent for the 61-cm trench backfilled with vermiculite and soil.

During periods of irrigation water shortages, narrow trenching could aid in producing a crop that would use water stored at a greater soil depth. For example, plants growing on the control plot in this experiment showed wilt symptoms of moisture stress 4 to 5 days earlier than plants over the trenches even though the percent moisture at the 15 to 90-cm depth was greater in the control plot.

Moreover, all trench treatments disrupted the dense subsurface of the clay soil and resulted in deeper root penetration. Root weights varied little among treatments, but root distribution was much affected. The cotton taproot growing under the deepest trenching conditions was observed to follow the trench and reach a depth of 122 cm as compared with 5-cm penetration for taproots of plants given conventional tillage. □

Right: Botanist Richard R. Yeo holds a mass of the slender-growing algae (Cladophora) which was growing in the spawning channels of the Tehama-Calusa Fish Facility. The barrel contains the new chemical, dubbed Dicop by Dr. Yeo, which successfully controlled the algae growth (0574X767–18A). Below: Dr. Yeo rakes the algae from one of the channels. The algae had clogged retention screens at the end of the spawning canals and inhibited growth of the juvenile King salmon. The dark areas in the water are heavy algae growth around gravel piles that were formed by the salmon during spawning (0574X767–10A).

New chemical saves fish facility

A NEW CHEMICAL control method for algae has made possible the successful operation of the Tehama-Colusa Fish Facility, near Red Bluff, Calif.

Even before operation of the fish spawning and rearing facility began 2 years ago, it was suspected that a long, slender-growing algae (Cladophora) would threaten the two spawning channels. The 1-mile-long channels are filled with grapefruit-sized rocks which the King salmon use as nesting areas, but which also provide an excellent medium for algae growth.

Shortly after opening, an extremely heavy algae growth quickly clogged retention screens, took up space that could be used for spawning, and caused other problems such as inaccurate read-

ings on fish-counting deviecs. The problem persisted during the winter when algae growth is usually at its minimum.

ARS botanist Richard R. Yeo, working in cooperation with the University of California, Davis; Bureau of Reclamation, U.S. Department of Interior; and the California Department of Water Resources, had been experimenting with a combination of copper sulfate and diquat (a chemical aquatic weedkiller to control the algae). The combination of the two chemicals, which Dr. Yeo dubbed Dicop, kills water weeds even at relatively low concentrations. Yet Dicop, as used to control the algae, has no toxic effect on juvenile or adult fish.

Adding Dicop to water in the two spawning canals when the fish reached the juvenile stage brought algae growth under control. Dr. Yeo, cooperating with Bureau of Sport Fisheries and Wildlife personnel, continued the treatments during the rest of the season until all the fish were released into the Sacramento River in the summer, ready to begin their long journey to the ocean. Over 2 million young fish were released. When the facilities are complete up to 30 million fish will be released each year.

Bioassay studies show that Dicop can be used safely while the fish are in the egg, alevin, or fry stages.

It is believed that diquat, in combination with copper sulfate, has the effect of holding more copper ion in contact with the aquatic weed surface, thereby causing increased absorption of copper by the plants.

Each chemical by itself is not effective in controlling weed growth at these low concentrations. Copper sulfate is an effective algae killer, but the high concentrations needed to control algae growth are toxic to fish.

The Tehama-Colusa Fish Facility is an integral part of the Tehama-Colusa Irrigation Canal and was designed to replenish some of the King salmon that failed to return to spawning grounds when a diversion dam was constructed on the Sacramento River. □

Making prairies blossom

A BARREN PRAIRIE, vacant of greenery, transformed into a viridescent field without the land's surface being extensively slashed with irrigation canals? It's possible. Gravel mulch may enable crop production in presently uncultivated semiarid lands, and could stabilize dryland crop yields where irrigation water is scarce.

Recent ARS tests show that gravel mulch increases crop yields on bare soil by reducing soil water evaporation and by increasing soil temperatures. A practical method of using the gravel mulch would be a boon to food production.

Scientists estimate that 25 to 50 percent of applied irrigation water evaporates from the soil before it can be used by crops. By reducing the soil water evaporation rate, gravel mulch makes more water available for plant transpiration.

ARS soil scientist Merle L. Fairbourn, Fort Collins, Colo., tested gravel mulch in laboratory and field experiments. The mulch consisted of ¾-inch gravel placed 1.0 to 1.5 inches deep on the soil surface between crop rows. He compared all of his test results with results obtained from a normal bare soil surface.

Large pores perforating the gravel permitted rapid water infiltration into the soil. The gravel, acting as a one-way valve, slowed water evaporating back to the atmosphere as vapors were forced to cross irregular pressure areas caused by the pore spaces.

Soil temperatures at a 6-inch depth were 2° to 4° C. higher under the gravel mulch than under bare soil. Germination and seedling emergence occurred 2 to 3 days earlier under the gravel. After plant canopies shaded the soil in July, soil temperatures became quite similar for both treatments.

Mr. Fairbourn's study emphasized two management practices essential when using gravel mulch. Four-inch bare crop rows are needed between gravel mulched areas to prevent plant damage from sunlight reflected off the gravel. Also, gravel mulch must be annually lifted and placed on top of the soil. Otherwise, it becomes mixed with soil and loses its water-conserving effectiveness.

A gravel-extracting, soil-sifting (GESS) machine developed by University of Arizona agricultural engineer C. Brent Cluff, Tucson, working with Mr. Fairbourn, exhibits good potential for establishing a mulch from naturally occurring gravel in the top 4 to 6 inches of the soil profile, or for regenerating an established mulch.

Additional research must be conducted both in the use of gravel mulch for growing crops in different climates, and in constructing improved equipment for regenerating mulch. □

Taking a closer look at the "enemy," veterinarian Thomas E. Walton and the lab's photographer, Mary R. Ingram, inspect electronmicrographs of Venezuelan equine encephalomyelitis (VEE) virus. The photos give the researchers insight into the morphology and location of the virus as it occurs n an infected host (0674X815–25).

Guarding a

CONTRARY to rising beliefs, Venezuelan equine encephalomyelitis (VEE), the horse disease that invaded this country in the summer of 1971, is neither dead nor buried in history. Today, the disease is still widespread in South America: a biologic menace that could reenter the United States and start another epidemic should horsemen relax their guard.

The 1971 outbreak was brought under control by using a U.S. Army-developed attenuated VEE live-virus vaccine, strain TC–83, in conjunction with aerial spraying to kill mosquitoes and a strict quarantine on horses entering the country. Since then, control measures have been relaxed. According to veterinarians, fewer horses are being vaccinated as horsemen no longer feel threatened by VEE.

Many veterinarians believe the present imprudence invites another outbreak. To prepare for other possible

Left: Veterinarian Michael M. Jochim and lab technician Ann J. Hoyt fill trays to set up a hemagglutination-inhibition test, a standard diagnostic test for the identification of virus strains (0674X812–7). Above: A roller bottle culture of a cell line used to grow VEE virus is examined under the microscope by microbiologist Bonnie M. Bando to determine growth and quality of the virus strains (0674X810–15).

ainst another VEE attack

epidemics. researchers at the ARS Arthropod-borne Animal Disease Research Laboratory, Denver, Colo., are studying the VEE vaccine to learn more about its strengths and limitations.

In one test, 50 horses which had been vaccinated with TC–83 vaccine were studied to determine the duration of the vaccine-stimulated immunity. ARS veterinarians Thomas E. Walton, Albert J. Luedke, and Michael M. Jochim, along with George L. Crenshaw, University of California at Davis, and James A. Ferguson, School of Epidemiology and Public Health, Berkeley, Calif., conducted the study.

The researchers inoculated mares, stallions, and geldings from 1½ to 15 years of age, including 44 ponies, 5 thoroughbreds, and 1 quarterhorse. The researchers also used six ponies as control horses to test the virulent virus pathogenicity.

At selected intervals following vaccination. the veterinarians challenged horse immunity with an equine virulent VEE virus strain. Challenges occurred from 9 to 19 months after vaccination, and always in the insect-secure, viral-safe isolation lab at Denver.

All 50 horses survived immunity challenges. The six control horses exhibited typical VEE clinical signs, blood virus concentrations, seriological responses, and VEE infection lesions. All six animals died.

High virus-combating antibody concentrations later detected in the blood of all inoculated animals provided concrete evidence that VEE vaccine strain TC–83 produces solid, long-lasting immunity.

Dr. Jochim and ARS veterinarian Thomas L. Barber, also at Denver. next turned to exploring the interaction between the VEE vaccine and a bivalent vaccine (one vaccine for two diseases) used to combat two other horse diseases, Eastern equine encephalomyelitis (EEE) and Western equine encephalomyelitis (WEE). Horsemen are concerned that the bivalent vaccine or the natural exposure to EEE or WEE may interfere with the VEE vaccine's immunity-bestowing powers.

Studying 82 horses over a 1-year period, Dr. Jochim and Dr. Barber exposed test animals to EEE and WEE vaccine either prior to or at the same time that they administered the VEE vaccine.

Horses vaccinated simultaneously with the bivalent EEE–WEE vaccine and the VEE vaccine developed VEE antibody concentrations equal to or greater than horses given only VEE vaccine. The horses also gave better immunity responses than those given the bivalent vaccine before receiving the VEE treatment.

Although preexistent EEE–WEE antibodies did interfere with VEE

antibody development, this interference did not leave animals susceptible to VEE infection. The ARS researchers believe horsemen might find it desirable to inoculate their animals against all three viruses at the same time, for the increased protection as well as the convenience.

Continued vaccination of horses is essential, particularly in the southwestern and southern States, the veterinarians said. Containing VEE by surrounding an active disease center (Central America and Mexico) with a band of immunized horses failed in 1970 and 1971. Most likely, they said it will fail again, probably because the disease is transmitted by insects that can skip over such a band.

ARS studies show the VEE vaccine to be safe and effective. History shows it to be necessary. □

Above right: *Working in an isolation chamber, biological technician John F. Hermanussen checks growth of mosquito eggs as veterinarian David H. Akey records data. The mosquitoes are later infected with the VEE virus under the quarantine conditions at the lab (0674X811–41).* ***Right:*** *Mosquitoes are the principal carriers of the VEE disease across the U.S. border from Central America and Mexico (BN–33276).*

Below right: *Before entering or leaving the maximum quarantine facilities under which they work at the Denver lab, all personnel must undress and shower. Here, veterinarians Thomas L. Barber (standing) and Albert J. Luedke don lab suits which, when removed, are left on the contaminated side of the clean room (0674X809–4).*

Summer protection for woolens

RETIRED for summer storage, that expensive camel's hair topcoat and those brand new blankets are a veritable woolen smorgasbord for hungry fabric insect larvae. Nobody knows this better than the consumer-homeowner.

Not all chlorinated hydrocarbon insecticides currently available to the homeowner may be completely effective against these pests. Resmethrin, a synthetic pyrethroid-type insecticide, applied to woolens as an aerosol spray for protection against insect feeding damage, is the subject of ARS research in Savannah, Ga. This broad-spectrum insecticide is lethal to destructive carpet beetles and webbing clothes moths but has a safe range of toxicity to humans and animals.

Established earlier as an effective moth proofer in laboratory tests conducted by entomologist Roy E. Bry and biological technicians Joe H. Lang and Ronald E. Boatright, resmethrin sprays have now been applied directly to freshly emerged adults and test-age larvae of both the black carpet beetle and the webbing clothes moth.

Employing disposable petri dishes—whose bottoms were lined with standard moth test cloth—the researchers introduced 40 insects of both species (10 larvae or adults per petri dish) into four dishes. They then sprayed the insects at a distance of 14 to 13 inches for 3 seconds, with a resmethrin oil aerosol and with an aqueous pressurized resmethrin spray. After three replications, the scientists placed the petri dishes in a darkened cabinet in a room maintained at a temperature of 26° to 28° C.

Toxicity of the resmethrin spray applications was determined by the number of dead-plus-moribund insects observed 24 and 48 hours after spraying. An insect which does not move or responds only feebly when stimulated gently with a needle is dead-plus-moribund.

Both aqueous and oil formulations of the spray were effective against adults and larvae of the carpet beetle. All were dead-plus-moribund in 48 hours. The aqueous formulation was not quite as effective as the oil aerosol against the adult clothes moth at 24 hours, but both formulations proved equally effective after 48 hours. Both formulations were equally effective against the webbing clothes moth larvae.

In corollary experiments at the Stored-Product Insects Research and Development Laboratory in Savannah, researchers Dr. Bry and Mr. Lang also successfully applied acetone solutions of: (1) pyrethrins, and (2) pyrethrins and piperonyl butoxide to woolen cloth. Initially and after the treatments had aged for 6 months, the cloth was satisfactorily protected against the larvae of the black carpet beetle.

"Pyrethrins and resmethrin are very suitable for development as short-term protectants during summer storage, in a closet, for instance," Dr. Bry said. "They afford protection for 6 to 8 months, they have low mammalian toxicity, and their residual life is short. They don't linger."

Considering the high biological efficiency of these chemicals, the bugs won't either. □

Unlocking the secrets of Lebanon bologna

EVERYBODY may soon be able to enjoy Lebanon bologna, a delicatessen favorite largely restricted to southeastern Pennsylvania where the Pennsylvania Dutch have made it for years by their old European recipes.

Taking its name from a center of the Pennsylvania Dutch community, Lebanon bologna is a highly smoked, spiced, and fermented beef sausage with a dark, reddish-brown color. Part of the secret of its characteristic flavor was long thought to be the wooden barrels in which the processors in Lebanon age their meat at low temperature (41° F.) and the special wooden smokehouses in which they smoke the bologna at high humidity (93 percent) and relatively low temperature (95° F.).

Less than 100 miles from Lebanon, ARS microbiologists and food technologists at the Eastern Regional Research Center in Philadelphia have taken much of the mystery out of making this sandwich delicacy. Their analysis of the micro-organisms responsible for the flavor, texture, and color of Lebanon bologna, and the proc-

Below left: *Microbiologists Samuel A. Palumbo (left) and James L. Smith stuff casings with meat before curing. In their efforts to unlock the secrets of Lebanon bologna, the researchers found that the percentage of salt with which the meat is cured is the critical factor in producing the Pennsylvania Dutch delicacy. After stuffing, the bologna is cured by smoke (PN–2864).* ***Below right:*** *Dr. Palumbo prepares the ground meat mixture just before it is salted and aged for 10 days (PN–2867).*

esses for their formation, have enabled the scientists to duplicate the product in their laboratory.

Lebanon bolgona is made by coarsely grinding beef; adding salt; aging at low temperatures; adding nitrate, sugar, and spices; finely grinding and stuffing into casings for curing with smoke; and then mellowing at low temperatures.

Processing experiments by microbiologists Samuel A. Palumbo and James L. Smith have showed that continued use of old barrels for aging the meat was not necessary to build up the desirable microbial flora, as had been supposed. New wooden barrels were just as effective; in fact, the aging could be done as well in plastic bags.

What is critical, Drs. Palumbo and Smith found, is the amount of salt with which the meat is aged. Three percent is just about right to give the product a good color and texture. This is enough salt to encourage development of the micrococci that reduce the nitrate—subsequently used for curing—to nitrite for good color and keeping properties. More than 3 percent salt inhibits lactic-acid bacteria from developing. These bacteria are needed to decrease the pH of the product, that is, increase its acidity, so that it develops the required firmness of texture. Also, the lower pH enhances formation of the cured-meat color (nitric oxide hemochrome).

Ten days were required for adequate aging. Then potassium nitrate was added, along with sugars and spices, and the meat was finely ground and stuffed into casings for curing. The bolognas were cured by incubating them in a smokehouse.

A 48-hour cure was usually sufficient to lower the pH. Curing with smoke made the bologna firmer in texture and improved its keeping properties. The modern air-conditioned smokehouse used for curing at the Philadelphia Center was modified to duplicate the low-temperature, high-humidity conditions prevailing in the wooden smokehouses used in Lebanon to make this product. After curing, some of the bolognas were mellowed for 3 days at low temperature (41° F.) before evaluation.

Generally, the experimental bolognas were similar in composition to the commercial product, but contained less fat and were somewhat higher in acidity. A taste panel preferred the experimental bolognas. The panelists slightly favored the mellowed samples over those just removed from the smokehouse, but the differences were not significant statistically. □

Pie thickener from apple wastes

Apple peels and cores from processing plants—known as press cake—can be made into a satisfactory thickening and flavoring ingredient for apple pie fillings.

Press cake presently poses disposal problems for apple processors. The cake is poor animal feed because it contains little protein and is only available at certain times of the year. It does not compete well with citrus peel in the manufacturing of pectin because of the much greater concentration of pectin in citrus. Usually press cake is disposed of by tilling into the soil.

Apple peels do, however, contain much apple aroma and pectin, valuable characteristics in thickeners and texturizers. The apple press cake could substitute for starch as a filling thickener.

ARS food technologists have made pie fillings with 2 to 3 percent press cake powder as the thickener. None of these pies boiled out when baked. The fillings with 2 percent powder are slightly juicy, while the 3 percent fillings are somewhat drier.

The press cake powder gives the pie fillings a brownish color, imparting a more homemade look, which may provide additional customer appeal.

Studies conducted by chemical engineer John L. Bomben and chemist Dante G. Guadagni at the ARS Western Regional Research Center, Berkeley, Calif., show that pies made from the powder have a slightly grainier texture when compared to the smooth, clear, glossy appearance of the starch-thickened fillings. This problem could probably be eliminated by grinding the press cake finer with a special mill, the researchers said.

Although pies made with the press cake powder are distinctly different from those made with starch, taste panels at the Center judged the pies made from the powder of Gravenstein and Winesap apples to be more flavorful than those made with starch.

Adding apple aroma concentrate increased the flavor of pies, especially those made from press cake powder of Gravenstein and Pippin apples.

Briefly, the process for making the powder consists of collecting the peels and cores under sanitary conditions, separating out seeds and stems, macerating, pressing, drying, and finally grinding the press cake into a fine powder. More apple aroma can be added to the press cake powder by adding high concentrate (10,000-fold) apple aroma which is produced from the juice pressed from peels and cores. Adding the highly concentrated apple aroma restores up to three-fourths of the aroma which is originally present in fresh apple peels. □

Coping with the sugar crunch

NINETEEN SEVENTY-FOUR has become the third consecutive year in which world demand for sugar has outpaced world production. A future crunch in sugar supply cannot be ruled out unless great strides are made in improving genetic stocks.

Indian scientists, cooperating with the already accelerated ARS-sugarcane breeding program (AGR. RES., October 1973, p. 3), have developed new breeding stock carrying various degrees of disease resistance and possessing good agronomic characters.

This 5-year ARS-sponsored project began in 1968. Its primary objective was to hybridize cultivated Hawaiian and Puerto Rican sugarcane varieties with Indian clones of wild *Saccharum spontaneum* and other *Saccharum* lines to develop hardy basic stocks suitable for superior commercial varities.

ARS-cooperating scientist Robert E. Coleman, Beltsville, Md., said the most important achievement of the project was the development of 63 elite Indo-American (IA) clones. "These IA clones," Dr. Coleman said, "and the progeny from 529 grams of seed raised from crosses with Hawaiian clones are now retained in the United States as basic genetic stock. The use of this genetic material will enable U.S. sugarcane breeders to reduce losses from mosaic in Louisiana, from sugarcane smut recently discovered in Hawaii, and from ratoon stunting disease in all domestic production areas."

Another benefit from this research was the information derived on the disease reaction and drought resistance of 41 Hawaiian and 60 Puerto Rican cultivars which the Indians tested. The Indian research also points to the potential for selection among self-pollinated segregates for higher sugar content and other desirable traits. Twenty *S. spontaneum* genotypes used in the breeding program were self-pollinated in order to get segregates with more desirable characters than the original parents. The Indian scientists found clones with a distinct sucrose content improvement in the self-pollinated population of four of these genotypes.

This Public Law 480 project was conducted under the direction of Dr. J. Thuljaram Rao and Dr. S. S. Shah at the Sugarcane Breeding Institute, Coimbatore, India. □

The threat of Jaagsiekte

RESEARCH in Yugoslavia reconfirms other studies that sheep pulmonary adenomatosis (SPA), a malignant lung disease, may be caused by a herpes-like virus.

SPA, also called Jaagsiekte, is prevalent in countries in Europe, Africa, and Latin America, but has not, as yet, been diagnosed in the United States. Virologist John R. Gorham, cooperating scientist in the ARS-sponsored work, and others have been on the alert for the presence of this disease in the western United States for the past 15 years.

Dr. Gorham of Washington State University, Pullman, said research on SPA is particularly important to U.S. agriculture because the disease is one of the slow virus infections, which have incubation periods measured in years. There are no known recoveries.

Because of the long incubation period, the usual quarantine procedures may not be effective. The disease could enter the United States with seemingly healthy sheep and establish itself in flocks at a later date.

The diagnostic problem is compounded because SPA begins, like certain other sheep lung diseases, with a progressive pneumonia and can be confused with maedi. Maedi, which does occur in the United States, is a progressive pneumonia in sheep. It is caused by a different viral agent.

The causal agent of SPA induces lung tissue cells to proliferate atypically, resulting in multiple tumors that may spread to lymph nodes and other tissues.

"If Jaagsiekte should enter the United States," Dr. Gorham said, "we will need adequate scientific data to combat the disease. In the meantime, in what would have been high-risk research if conducted in this country, the Yugoslavs have helped resolve some of the controversies about SPA. Besides isolating a suspect causative agent, they have confirmed that SPA is transmissible."

Dr. Gorham said that research needs to be done to develop serological tests for early diagnosis and, ideally, a vaccine for the control of the disease.

Another important reason for continued study: SPA would make a fine model for studying certain forms of human lung cancer with similar progressions.

The project, conducted under the Public Law 480 program, was directed by Dr. Vladimir Cvjetanovic at the Institute of Agriculture, Titograd, Yugoslavia. □

APHIS tightens importation watch

SCIENTISTS who attempt to bring foreign plants, plant and animal pests, pathogens, or vectors from abroad for research purposes may be violating Federal statutes and risking loss of their collections. Time and trouble can be saved by obtaining a permit from the U.S. Department of Agriculture (USDA) before attempting to bring such organisms into the country.

"Because of the danger of new plant pests and diseases gaining a foothold in this country, USDA is tightening enforcement of pest movement and quarantine regulations," said Leo G. K. Iverson, Deputy Administrator of USDA's Animal and Plant Health Inspection Service (APHIS). "In the future, the type of materials permitted will be more closely regulated, violations will be publicized, and facilities where specimens are housed will be inspected more frequently."

Securing a permit before importation of such research materials requires little time or effort. Applications are usually processed within 10 days. Scientists are advised, however, to begin the application process 30 days before they expect to import live pest organisms or vectors.

Decisions on whether to issue permits are made on an "environmental risk" versus "expected benefits" basis. In many cases, permits specify safeguards that must be used in shipping, handling, treating, and maintaining and disposing of research organisms.

Issuance of a Federal import permit does not necessarily mean research organisms can be moved freely between the States, or in some cases, within a State. State approval may also be necessary.

"Agricultural quarantine restrictions on importation of foreign plants, and plant and animal pests, pathogens, and vectors are not intended as barriers to research," Mr. Iverson said. "Rather, they are designed to protect America's plant and animal resources from foreign pest invasions."

Mr. Iverson said that quarantines are being violated every day by scientists who are unaware of quarantine restrictions. For example, last summer APHIS port-of-entry inspectors stopped a number of students, all from the same university, attempting to bring prohibited plants into this country. The inspectors were amazed to learn that the students' professor had asked them to bring back plants from their vacations in the Orient. He wanted them in their natural state—pests and all!

Before the tighter enforcement measures are stressed, APHIS wants all scientists to be aware of quarantine restrictions and the need for permits. The agency has prepared a pamphlet outlining how to apply for permits and the process of evaluation and issuance. It is available free of charge from APHIS Information, USDA, South Building, Room 1154, Washington, D.C. 20250.

Higher yields with tall sorghums

A SERIES of studies indicates that tall sorghums appear superior to the very short (4-dwarf) in yielding ability. The advantage was present at various stand densities and suggests that farmers growing very short sorghum, either pure lines or hybrids, may be reducing their yield potential.

In these ARS studies, conducted at the Texas Agricultural Experiment Station, College Station, geneticist K. F. Schertz compared three pure lines (one short and two tall mutant) and six hybrids (four tall and two short). All were planted at two-stand densities in standard row widths, 96,873 plants per hectare planted 10 centimeters (cm) apart, and 193,746 plants per hectare planted 5 cm apart.

Results showed that total grain yield was greater in the tall sorghums and more grain was produced in the 5-cm stand due to the greater number of plants. This was true for the pure lines as well as the hybrids.

Yields of the tall pure lines and hybrids were greater than those of their short counterparts because of greater kernel weight rather than the number of kernels per plant.

The tall pure lines yielded 4,804 and 4,847 kilograms (kg) per hectare, respectively, while the short pure lines yielded only 3,471 kg per hectare.

Similarly, the tall hybrids yielded up to a high of 4,540 kg of grain per hectare while the short hybrids yielded only 3,433 kg of grain per hectare.

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AGR 101

AGRISEARCH NOTES

Pheromone traps Comstock mealybug

PHEROMONE TRAPS are detecting Comstock mealybugs in a 7-year eradication program spearheaded by the California Department of Agriculture.

The trap, developed by ARS, is made from pint ice cream cartons baited with virgin female mealybugs. Sex attractant pheromones lure flying males which are caught on a sticky card on top of the carton.

Success with a similar trap for the red scale pest of citrus (AGR. RES., January 1972, p. 5) led University of California researchers to invite ARS participation in controlling the mealybug.

The Comstock mealybug, a relatively new pest in the Southwest, is confined to a 1,100-square-mile area around Porterville, Calif. It is a potential $7 million annual threat to the citrus industry there; this estimate does not include potential damage to about 60 subtropical fruit varieties and ornamentals. Mulberry trees are the preferred host of the mealybug, but the pest feeds on any of more than 70 other hosts including citrus and pomegranates.

ARS scientists have set up three trailers to serve as insectaries near Porterville, and are furnishing the State with female mealybugs to bait an anticipated 2,500 traps during 1974.

The traps take the place of visual inspection of trees, a tedious, less efficient, and much more costly way of detection.

When the populations of the mealybug reach a certain density, eradicative action involves selected chemical sprays, release of biological agents, and strict quarantine of the area.

Development of a synthetic pheromone—now being investigated—should provide a cheaper source of the attractant, a more reliable trap, and a much safer lure because the potential hazard of females escaping from broken traps would be eliminated.

ARS entomologists David K. Reed, Daniel S. Moreno, and John G. Shaw (retired), Riverside, developed the mealybug trap at the request of University of California entomologist Irwin M. Newell, also at Riverside.

Mirex and reproduction

SMALL AMOUNTS of mirex in feed rations apparently have little effect upon reproduction in either chickens or Japanese quail.

Up to 160 parts per million (ppm) of mirex in diets of laying chickens and up to 80 ppm in diets of laying Japanese quail for 12 weeks did not affect egg production, egg weight, shell thickness, shell calcium, proportion of broken eggs, or proportion of soft-shelled eggs. Neither was there a significant effect on eggshell weight, fertility, or hatchability of quail eggs in studies at the ARS Metabolism and Radiation Research Laboratory, Fargo, N. Dak.

Mirex, a chlorinated hydrocarbon insecticide, is applied at 1.7 grams per acre to control the imported fire ant in the Southeast.

Physiologist Kenneth L. Davison, biological aide Judith H. Cox, and statistician Charles K. Graham conducted the study.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

U. S. GOVERNMENT PRINTING OFFICE : 1974 O - 554-305